Two Ways to Help

AMERICAN cities and states are feverishly working to prepare themselves to offer at least passive resistance to air raids. Defense plants are teeming with industry and tanks, planes, and ships are rolling out. The sleeping giant has awakened.

But where does Traffic Engineering fit into this swiftly moving picture? There are two distinct approaches over which the Traffic Engineer can be of great aid to his country in this time of need.

First is the older and more familiar avenue of the elimination of congestion and accidents especially on those routes which carry defense workers and defense materials. America was built to its present power with the aid of the motor car and truck, and the rapid, flexible transportation which they afford. We cannot let our war effort be hampered by their inefficient operation. This fact was apparent to the Institute of Traffic Engineers several months before Pearl Harbor and the program for economic and safe traffic movement in defense areas was prepared.

We are fighting for the four freedoms as listed by the President of the United States. To preserve these four freedoms we must have a fifth, "Freedom of War Production Transport."

Another contribution the Traffic Engineer can make to the National Security is the active participation in Civilian Defense. This is a civilian war just as much as it is a soldier war, and disruption of normal civilian life is one of the enemy's chief aims. Therefore we must expect him to attempt to sabotage our industries and bomb us into confusion. This we must prevent. But civilians cannot shoot back. They can only offer passive resistance and maintain order in the heart of chaos.

The training of the Traffic Engineer has equipped him to be of inestimable aid in his program. For years he has considered safety of civilians and efficiency of operation of paramount importance. Why should he now hesitate to make his training and experience available to those hard pressed authorities who are fighting for civilian defense?

Let's extend our working hours even further, if necessary, to help in this emergency.

T. J. Sebum

Member, Board of Direction

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TRANSPORTING WAR WORKERS IN PORTLAND, OREGON

by RALPH COLLETT

PORTLAND, Oregon, is now the center of a new industrial region vast enough to double the city's working population within a year. The street and transportation systems, which were fairly satisfactory for normal activities, are taxed to the saturation point in several areas. Traffic volumes on two major bridges which were already near capacity during peak hours in 1941 have doubled. Two-lane residential streets with normal daily volumes of 500 vehicles must now carry six times that number in one-half hour. Moderately heavy intersections are now bottlenecks affecting traffic flow as far as 14 blocks. Employment is still at least 60 per cent below the anticipated peak.

By the end of 1942 three Portland shipyards alone will employ 90,000 men which means, including their families, that the entire city population will be increased 100 per cent.

The manner in which the private car has taken over the field of transportation is well known. Also well known is its inefficiency as a means of mass movement. Efficiency, in the past few years has been sacrificed to increased convenience and speed.

Facilities for mass transportation have declined in the Portland area just as they have in other areas. Obsolete equipment has been retired, and few, if any, replacements ordered due to passenger loss. Personnel and maintenance facilities have been cut to a minimum. The major urban transportation company has shown annual net losses for the past fourteen years.

New industries, as well as the shipyards, have placed an additional burden upon the mass transportation systems far beyond their capacity. The greater demand for transportation is occasioned by the increased population and the curtailment of private car operation. A housing shortage also added to the difficulty by necessitating greater travel between home and place of employment. Certain of the industries are, of necessity, so located that to serve them a great number of mass transportation units would have to be diverted from other runs at hours when they could not be spared.

In short, the city and surrounding area were required to change, practically overnight, from a standard of wasteful abundance to one of rigid efficiency.

The first reaction on the part of the industries was an attempt to forestall a too rapid reduction in private car use because the lack of other means of transportation was well known. Temporary programs of "doubling-up" cooperative bus buying, etc., were promoted. "Doubling-up" was urged by means of publicity in newspapers, radio and posters; by reserving desirable parking areas for fully-loaded cars; by the distribution of windshield stickers and lists of employees designed to enable contacts to be made between passengers and cars. This program, coupled with the actuality of the tire shortage, raised the passenger-to-car ration at the Oregon Shipbuilding Corporation yard from 1.6 in September, 1941, to 3.1 in March, 1942. There is every indication that this trend will continue, possibly even to a 4.3 ratio.

Cooperative bus purchasing has not been pushed extensively in Portland for two reasons: first, the possibility that the local traction company or some other cooperating organization would obtain additional equipment; and second, the lack of responsibility of the "cooperative" groups in failing to undertake any insurance program or to obey city and state testing and permit ordinances and regulations.

The problem, however, has developed to an extent where it can no longer be ignored. Either the local traction company must obtain additional equipment which would be an effective means of stopping "co-op" buses or the "co-op" groups must be encouraged under regulation.

Two major difficulties stand in the way of the local transportation company's attempts to obtain equipment. The first is through the conversion of the manufacturing industries to war production with the resultant scarcity of new equipment, and the second is the uncertainty of the definition of the term "duration." Private capital insists on an amortization period of two years or less, and consequently must operate the equipment to capacity at more than peak hours to show an operating profit.

In regard to availability, there is a scarcity of new equipment even under a high priority rating. There is, however, an enormous amount of equipment, mainly buses, throughout the country, which are either not being used at all, or are running to less than one-quarter capacity at any time, and which could be coordinated into the traction company's operations. Many of the smaller common carrier bus lines are operating far below capacity even in peak hours because they are eliminated from heavier city loads by existing franchises. Certain school districts have, by concentrating the use of their equipment, made a large number of buses available (so far unaccepted). One national park in the West has 480 buses which it is willing to sell, and even more if, as is anticipated, tourist traffic is curtailed. Other agencies have similar equipment in smaller numbers. From these sources equipment is available which should be put to work.

Water and rail facilities are as deficient as street transportation, if not worse. Passenger traffic by water has declined during the past fifteen years to a point where it is practically nonexistent. Boats have either been sold

out of the area or converted to freight use, and as such, are in service at the present time. The limited amount of extra rolling railroad stock is being overtaxed with the increase in through freight and passenger service and in troop movements.

Providing the means of transportation for shipyards is only one of the problems. Parking facilities sufficient for at least two shifts must be provided since one shift must be parked at the time the preceding one leaves.

The inadequacy of the existing access streets to the yards has created some very definite problems. Some streets have already been widened and improved and additional work of this kind is contemplated. With enforced curtailment of the use of the private passenger car and the return to mass transportation, the question may be raised as to the necessity of constructing streets of greater width. In this respect the Oregon State Highway Department and the City of Portland have considered it unsafe to assume that the shortages curtailing the use of the private car will continue indefinitely, and consequently have planned a system of access streets adequate for private car use.

The fact that the directional flow is predominantly one way at a time serves to simplify the problem to some extent. For this reason practically all of the access streets may be used either to or from the yards. On some multiple-lane streets all but one lane is used in one direction at a time, despite some minor inconvenience to other traffic and the need for additional policing.

The most satisfactory solution to these problems is obviously greater use of mass transportation facilities. Accomplishment of this objective involves many difficulties but it can be done.

An original article by Ralph Collett, Traffic Director, Oregon Shipbuilding Corporation, Kaiser Company, Incorporated, and formerly Engineer Assistant, Traffic Engineering Division, Oregon State Highway Department.

SIGNAL TIMING ADJUSTED TO PEAK LOADS

by G. W. Howie

TWO methods of transferring from one signal control dial to another, in order to change timing for peak traffic conditions without an erratic transitional period, have been devised in Portland, Oregon, by Traffic Engineer Fred T. Fowler and Signal Engineer Briggs Clark.

The transfer methods are in use on a coordinated signal system on East Burnside Street and Northeast Sandy Boulevard (Fig. 1), where heavy inbound traffic during the morning peak and even heavier outbound traffic volume in the evening peak have made it necessary to use three-dial controllers. Use of conventional transfer methods would have resulted in delays and accident hazard on already overcrowded streets.

Instead of the erratic signal timing during a transitional period which is characteristic of conventional transfer methods, the change invariably is made when traffic on the main artery has been given a green signal, with the result that there is no dislocation of traffic moving through the signal system.

Sandy Boulevard had been piling up an appalling record of traffic fatalities, personal injuries and damaged vehicles. When the Oregon State Highway Department and City of Portland undertook in 1938 the widening of this five-mile diagonal thoroughfare, State Traffic Engineer John Beakey and City Traffic Engineer Fowler foresaw a disastrous wave of collisions if the improvements failed to provide adequate traffic control.

In the first six months following the

widening and immediately preceding the operation of new signals, four traffic fatalities occurred—an annual rate double the annual traffic fatality rate on Sandy Boulevard during the preceding eight years.

From July, 1939, the date when the first units of the new signal system was placed in operation, until August 27, 1941, not a single traffic fatality took place on Sandy Boulevard. The two deaths which finally were chalked up against the 1941 record both occurred in early morning hours when the traffic signal control was out of operation. A recent order placed the signals on 24-hour operation due to the heavy volume of traffic moving to and from defense industries after midnight.

Speed and delay studies show that drivers have increased their average overall speed on Sandy Boulevard as a result of the signal installation, although top speeds were drastically reduced. The timing program, which has been improved through a succession of changes since 1939, now provides for a minimum of delay for the 25,000 cars using Sandy Boulevard on an average day.

The control system at present consists of traffic signals and channelization at complicated intersections.

The signals are coordinated for through movement of traffic in both directions at 17 to 24 miles an hour on Burnside Street and at 18 to 28 miles an hour on Sandy Boulevard. From Forty-second Avenue to Eighty-second Avenue signals uniformly spaced every five blocks continuously control speed in both directions at 30 miles an hour.

During the morning peak, a large volume of westbound cars is accommodated at 20 miles an hour through the more congested area and 28 miles an hour elsewhere. Eastbound traffic, comparatively light, encounters minor

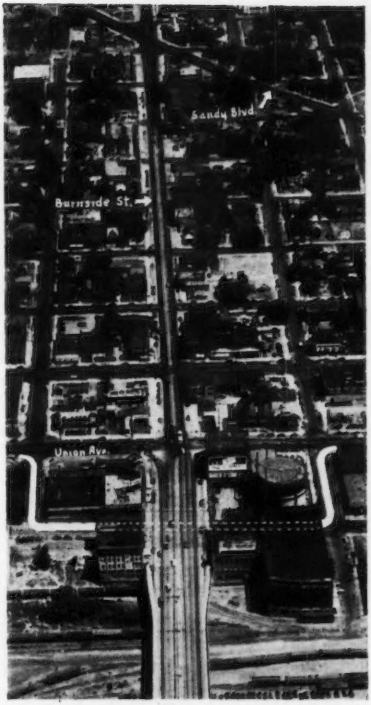


FIG. 1

delays not exceeding 10 seconds at two or three locations. The converse takes place during the evening peak, when eastbound traffic is given a clear way at 20 to 28 miles an hour.

Eastbound and westbound progression and delays are equally divided during the normal period, so that cars moving at 20 and 28 miles an hour may be required to stop for signal changes at not more than two locations in either direction. Drivers have learned to vary their driving speeds slightly so that they frequently drive the entire distance without a stop for signals.

Eagle Signal Corporation Synchronous motor controllers are used for local timing throughout the system.

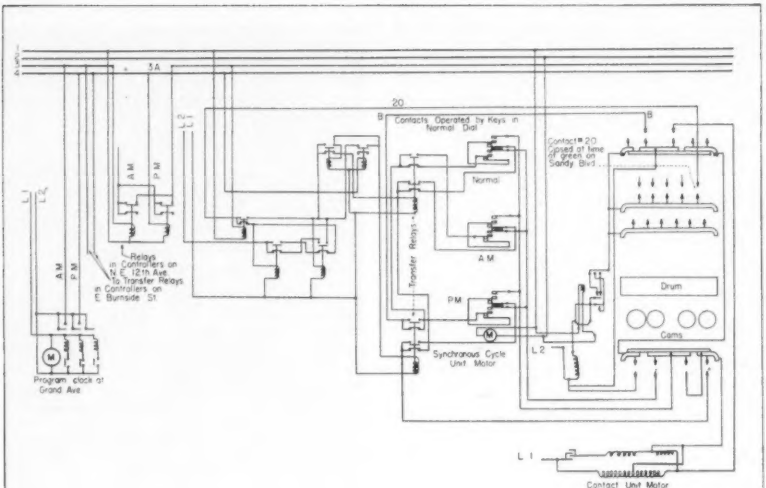

3A
20
Contacts Operated by Keys in Normal Dial
Contact #20 Closed at time of green on Sandy Blvd.
Normal
A M
P M
Transfer Relays
Drum
Cams
Synchronous Cycle Unit Motor
Relays in Controllers on N.E. 12th Ave. To Transfer Relays in Controllers on E. Burnside St.
Program clock at Grand Ave.
Contact Unit Motor (Induction)
CITY OF PORTLAND, OREGON
WIRING DIAGRAM FOR DIAL TRANSFER IN CONTROLLERS ON N.E. SANDY BLVD. FROM N.E. 16th TO 42nd. AVES.
Drawn by Haynes
Designed & Checked by Clark

FIG. 2

A seven-day program timer is used to master the local controllers in order to provide transfer to the morning peak timing, back to normal timing, then to evening peak timing and back to normal timing. The total cycle length is 60 seconds during normal timing and 75 seconds during the extended periods.

Auxiliary manual control may be used during the evening peak period at two intersections to clear out any excessive accumulation of eastbound traffic. The total cycle is unchanged, but two eastbound green periods and one westbound period are consolidated into a single eastbound green period of 100 seconds. This is accomplished by means of a push button, which by aid of relays, transfers all circuits for signals from the usual drum-operated contacts to other contacts which will remain closed during the extension. The push button must be operated during the time that the eastbound green is indicating on Burnside Street at both these intersections. When the relays have been operated, a holding circuit retains this condition until the timing unit and signal contact unit have proceeded to the position for the next green period in the same direction, when the control will automatically return to usual operation.

The two methods of transferring to and from normal timing for the peak periods are a cam arrangement on Burnside Street and a relay system on Sandy Boulevard. The relay method provides the most rapid transfer but could not be used satisfactoritly on Burnside Street due to the double-cycle timing program.

The relay method may be understood by reference to the wiring diagram (Fig. 2.) All controllers are alike, and at the time that the program clock energizes the control wire, No. 3 for the morning peak and No. 4 for the evening peak, a relay at each local

controller is closed and provides a circuit to the coil of the transfer relay. This circuit, however, is not completed until Contact No. 20 on the contact unit is closed, which occurs when the green light is showing for traffic on Sandy Boulevard. At this point, the transfer relay will operate, transferring the circuit from the normal period dial contacts to the extended period dial contacts.

The contact unit is mechanically arranged so that a special key in the timing dial is required to operate the contact drum, changing from the green to the amber on Sandy Boulevard, and therefore after the normal period contacts have been disconnected the green will remain on Sandy Boulevard until the special key of the extended period dial operates the drum, changing the signal to amber. Thus the length of the green period on Sandy Boulevard may vary in the particular cycle when transfer is taking place from a shortened time to nearly a complete cycle. Cross traffic is light enough so that the delay does not cause undue congestion.

In the Burnside Street controllers, the special key operates only once in two cycles. This would result in excessive delay for cross traffic if the relay system were used for transfer; therefore adjustable contact closing cams were added to each timing dial shaft and to the signal contact unit so that the coils of the transfer relays could not be energized until the timing dials being transferred are very nearly in the same relative positions and then only when the green is showing for traffic on Burnside Street. In this case also the green signal may be held on Burnside Street longer than the usual length of time, but never longer than one cycle. Because of the relative speed of the two dials, the normal dial at one revolution in 120 seconds and the extended period dial in 150 seconds, the actual transfer may be delayed for as much as 7½ minutes after the program clock energizes the transfer control wire.

The transfer at all intersections on either Sandy Boulevard or Burnside Street does not occur simultaneously but will usually take place within the time of one cycle.

The entire system utilizes standard three-light signals, and all intersections have both post-top mounted and center-suspended signals. Standard green arrow lenses are used to indicate special turning movements and standard walk-wait lenses are placed where their use results in a simplified installation at complicated intersections.

A digest of an original article by G. W. Howie, Bureau of Traffic Engineering, Portland, Oregon.

IMPROVED PEDESTRIAN CONTROL

by F. W. Taylor

GREATER efficiency can be obtained at a signalized intersection if the movements of pedestrians and vehicles are controlled by separate indications. To obtain maximum observance the number and location of signal heads should provide an indication directly ahead of the pedestrian at all times, regardless of which street he is crossing. Likewise, the vehicle operator should be supplied with an adequate indication which is visible as he approaches the intersection. Of equal importance is the type of pedestrian indication to be employed. The color combination or design must not be mistaken for a vehicle-control device when the two are used at the same intersection. It also should be simple and readily recognized by the pedestrian, and the "Walk" and "Wait" indications should be easily identified.

A carefully planned signalized intersection incorporating all the features mentioned above should produce satisfactory results, but this has not been the experience of the Traffic Engineering Division of the Oregon State Highway Department. At numerous intersections there are installed in this state, in accordance with the standard practice, a far right-hand corner pedestal mounted two-way 90 degree three-color vehicle and two unit Wait-Walk pedestrian signals. The response and control of the pedestrian traffic has not met expectations. Pedestrians have been educated for years to walk on the Green and are still legally doing so at many intersections in this state. Some of them are not far removed from locations where Wait-Walk pedestrian signals are in operation. Violations of the Wait indication are deliberate as well as unintentional. Impatient pedestrians purposely walk against the Wait during the Green-Wait period while others, being preoccupied, fail to observe the status of the pedestrian signal indication during this interval.

Noting the indifference of some pedestrians and the reluctance of others to be governed by the Wait and Walk indications when the Standard Red, Yellow and Green signal were mounted on the same pedestal, State Traffic Engineer, John Beakey, proposed the development of a plan where the vehicle and pedestrian signals are separated. The new plan not only improved the pedestrian control, but the possible methods of installation offered many economies, an almost compulsory requisite under the present wartime restrictions.

Having established the plan of installation, the next problem was the choice of Wait and Walk lenses. Not being totally satisfied with the combinations previously installed, available designs of pedestrian signal lenses were obtained and an experimental pairing and comparison conducted. Immediately all lenses having a color of red, yellow or green were ruled out because of the possibility of confusion with correspondingly colored vehicle signal indications. For example, a red lens black out except for the word "Wait" in letters of three thirty-seconds-inch stroke and three-inch height, lost its identity at night time and closely resembled a red vehicular signal when viewed from a distance of approximately one hundred and fifty feet.

The two lenses most effective were the standard ITE No. KL-3829, a clear WAIT with black background, and No. KL-3852, a lunar blue WALK with black background. In addition to having a difference in lettering, these two lenses had a visible color dissimilarity; the WAIT lens emitting a yellowish light and the WALK lens a bluish white hue when illuminated with clear traffic signal lamps.

The recently completed signal system in the city of Klamath Falls, Oregon, installed jointly by the City and State Highway Department, was the first installation in this state to employ the newly-developed plan. A typical signalized intersection constructed according to the plan used in Klamath Falls requires four twenty-five foot steel poles located on the far right-hand corners as shown in Fig. 1. Each pole has attached to it a two-way 90 degree Wait-Walk pedestrian signal mounted at an elevation of eight feet to the center of the lower lens. Near the top of the steel poles are fastened span guys from which are suspended four one-way three light vehicular signals, each facing the vehicular traffic directly across the intersection. The bottoms of these signals are at a clearance height of fifteen feet. The supervisory cable is installed in conduit placed below the street surface, but the electrical cables for the operation of the signal lights at

the intersection are carried across the streets by means of cable rings affixed to the span guys. The power service wiring is also carried overhead, thus necessitating a minimum of street breaking and repairing to complete the installation. A typical intersection is shown in Fig. 1.

FIG. 1

Junction boxes are placed on the steel poles for the purposes of joining the electrical cables carried on the span guys with the wiring which services the pedestrian signals. The controller cabinet is bracket-mounted and provided with a conduit connection from the bottom of the cabinet to the pole. The supervisory cable connections and the wiring between the controller and the top of the pole as well as the wiring connecting the junction box and the pedestrian signals are all contained within the pole.

The signal system in Klamath Falls consists of seven adjacent intersections located in the main business area of the city, four of these intersections being within the shopping district where the pedestrian movement is relatively heavy. The seven intersections are interconnected and supervised by a master controller. The Klamath Falls system was installed by Trowbridge and Flynn, electrical contractors of Klamath Falls, using Crouse-Hinds equipment.

The populace was familiar with the three-color vehicular signals, but the pedestrian indications were undoubtedly a new experience to the majority. After the pedestrians had become acquainted with the significance and operation of the Wait-Walk signals, their observance and behavior indicated that the removal of the green from the direct view of the pedestrian traffic decreased the confusion and violations experienced under the old system of having both the pedestrian and vehicular signals on the same pedestal.

Prior to the operation of the system, there was some discussion concerning the adequacy of a single Red, Yellow and Green signal head facing each phase of vehicular traffic. However, fears regarding the success of the single unit were unfounded. Of particular advantage was the removal of the signal from the competition of

neon and commercial lighting existing at the curb. The hanging of the signal over the far crosswalk placed the signal sufficiently distant from the stop line to permit the vehicle operator to see it without difficulty. The favorable response of the vehicle operators in Klamath Falls has prompted the Oregon State Highway Department to adopt a similar plan in the treatment of the isolated surburban intersections. At locations of this type the pedestrian signals are eliminated and one one-way three-color head is installed on each far right hand corner to supplement the overhead vehicular signal.

In the past, the State Highway Department has been exceedingly generous in the display of signal indications. Before the advent of pedestrian signals, some intersections were equipped with pedestal mounted two-way 90 degree three-color signals on each of the four corners and a four-way signal of the same color combination suspended directly over the center of the intersection. An installation of this type required twelve three-light heads, or a total of thirty-six single section units. After pedestrian signals came into being, many intersections jointly installed by the city of Portland, Oregon, and the State Highway Department used the previously described standard of pedestal mounted two-way three-color vehicle and two unit pedestrian signal heads on each of the four corners. An intersection following this system required forty signal section units. Under the new plan, a similar intersection in an urban area where pedestrian control is desired would require four two-way pedestrian signals and four one-way vehicles, the number of single units totaling twenty-eight. Construction of installations necessitating steel poles such as used in Klamath Falls will result in limited savings, but in locations where either wood poles or existing anchorages can be employed, an appreciable reduction in cost may be expected.

The method of signal installation described in this discussion has proven so successful that it is quite likely it will be adopted as the standard method of signal installation for the state of Oregon.

An original article by F. W. Taylor, Signal Engineer, Traffic Engineering Division, Oregon State Highway Department, Salem, Oregon.

RURAL ACCIDENT INVESTIGATION IN THE STATE OF WASHINGTON

by Lt. (j.g.) D. Hunter Harrold

SINCE the nature of traffic accident reporting makes the results of any analysis at best only approximate, it is frequently valuable to check the results of an analysis in one state with comparable ones in other states. It is in the light of this thesis that the following statistics, developed from a series of accident studies made in the State of Washington, are presented.

The statistics in question were developed from a study of rural fatal accidents occuring over a three-year period. The accidents were divided into three classifications as follows: Pedestrian accidents; single-car fatal accidents, of a type such as running off the roadway, overturning, etc.; and multiple-car accidents, such as head-on collisions, rear-end collisions, etc. Interestingly enough, each classification was almost exactly equal in the number of fatal accidents — the number in each one amounting to about 30 per cent of all fatal motor vehicle accidents, with the remaining 10 per cent falling into a miscellaneous classification, such as hitting deer, elk, livestock, etc. Each group was them analyzed to discover its out-

standing characteristic as to location and causes.

In rural pedestrian accidents the usual factors were uncovered. For example, eighty per cent of all rural pedestrian fatalities occurred during the hours of darkness; the month of November was found to be the month of greatest hazard, with the five-month period from August to December accounting for 67 per cent of rural pedestrian fatalities. Over 75 per cent of the pedestrians killed were over 40 years of age, 93 per cent of rural pedestrian fatalities were males. The most significant thing discovered from the standpoint of directing a program of pedestrian accident elimination came from the plotting of the location of these accidents on a spot map. This map showed that almost all of the pedestrian accidents were confined to three very small areas within a few miles of three centers of the state, namely; Seattle, Tacoma and Spokane. This fact is important not only for enforcement and education but also as a factor in the design of highway improvements in these localities. Strong support should come from these statistics for the construction of rural sidewalks and other pedestrian safeguards on roads in the vicinity of these municipalities.

Single-car fatal accidents, in contrast to pedestrian accidents, were found to be scattered all over the state, with a surprising share of them on roads of low traffic volume. A close examination of the character of the roadway showed that with only few exceptions these accidents tended to occur on sections of poor alignment. Two-thirds of all the rural fatal single-car accidents occurred on curves, while for all other types of fatal accidents this percentage amounted to only one-third.

Primary highways, carrying 67 percent of the total vehicular travel, recorded 22 per cent of the single-car fatalities. Secondary highways, accounting for 11 per cent of the travel, showed up as the location of 36 per cent of the fatalities; while county roads with 22 per cent of the vehicular travel, accounted for 42 per cent or the remainder of the single-car fatalities. On the basis of exposure represented by the volume of travel, ten times as many persons were killed on secondary highways in single-car accidents than in the same type of accident of primary highways.

60 per cent showed excessive speed as a contributing cause. Driver-asleep and driver-intoxicated were equally divided as principal causes in another 26 per cent. Drivers with the least driving experience were found to be most prone to this single-car type of accident.

The results of an analysis of single-car accidents indicate the need for such corrective measures as the signing of safe speeds on curves, widening and surfacing of shoulders, the delineation of stretches of road with bad alignment, etc.

The third category, multiple-car accidents, is a somewhat more complicated classification than the two previous ones. Of this group, 52 per cent were found to be head-on collisions, 18 per cent were rear-end collisions. Left turn and cross-movement accidents accounted for 12 per cent each. The remaining 6 per cent were classified as overtaking and passing accidents. This multiple-car type of accident was found to be concentrated on the highways of large traffic volume and especially on highways where high speeds prevailed. They are especially important, not only because of the large percentage of deaths attributed to them, but also because they account for 70 per cent of all rural property damage from traffic accidents. A priority of consideration should be given to multiple-car accidents. Their severity, frequency, and location on high-

volume, high-speed roads easily justify remedial treatment.

Spot maps for each of the three types of fatal accidents are maintained and compared year by year for any changes in pattern of occurrence. In conjunction with these maps are kept current fatality spot maps showing all rural traffic fatalities broken down only as to motor vehicle or pedestrian fatalities. A sudden cluster of pins at an intersection or on a certain stretch of road can be easily identified as to specific types by comparison with the three classification spot maps. From the maps alone, then, it is possible to pick out immediately a particularly hazardous location, to designate the prevailing type of accident, whether single-car, multiple-car or pedestrian, to determine the time of accident occurrence, whether day or night, and finally, to suggest the nature of the remedial treatment.

Special reports discussing the characteristics of accident types based on several years experience have been prepared and distributed to all local officials and persons generally interested in accident prevention. In brief, this is one phase of traffic accident investigation which this department has found valuable and deserving of continued interest. Doubtless, other departments have made similar studies and a comparison of the results would be of value to everyone engaged in accident research.

An original article by Lt. (j.g.) D. Hunter Harrold, formerly Assistant Traffic Engineer, Washington State Highway Department.

LARGE TRAFFIC SIGNS

by B. R. Downey

ONE of the first advantages that is generally thought of as accruing from large signs is the greater obtainable target value. Target value is the term applied to the characteristic which makes a sign stand out from other signs or objects near or about it. The use of a larger sign provides a larger background and undoubtedly commands more attention than would a smaller sign.

Perhaps the most important argument for the use of larger signs lies in the ability to use larger letters—in height and width—and larger symbols. The distance which a sign may be read is proportionate to the letter height and width.

Another advantage obtained in using large signs is that larger reflector elements can be used. The total light returning from a reflecting element is obtained by multiplying the average brightness by the total luminous area of the reflector element. Thus, brightness being equal, the amount of light reflected from element is proportionate to its area. For instance, a reflector button of 1" diameter could reflect four times as much light as one which has a diameter of ½". Since brightness diminishes inversely to the square of the distance, reflectors must be of sufficient area to reflect the small amount of light that may reach them. For instance, only .025 foot candles would be received reflectors 1,000 feet from a vehicle emitting 25,000 beam candles and a large reflecting area returns this small amount of light more efficiently than one with less reflecting surface. Reflectors will reflect light a greater distance, up to 2,000 feet, under good conditions; whereas, the range of vehicle headlights is about 500' or less. Thus, large reflector elements that will reflect a greater amount of light at longer distances serve to extend the range of visibility at night by their ability to reflect beyond the range of headlights.

There are many locations where conditions make it necessary to place a sign at the point described by the

sign. In such instances it is imperative that the sign be large enough to give adequate legibility distance and warning time. This condition is illustrated by the locations at which it is necessary to stop traffic. Because of drivers' habits and characteristics, "STOP" signs must be placed at the point of obedience if proper compliance to the sign is to be obtained. In the past the practice has been on high speed roads to augment the 24 inch "STOP" sign with a standard 24 inch pre-warning sign. Michigan experience has shown that this method of warning is inadequate. Better results are obtained by increasing the size of the "STOP" sign. Of course, it is sometimes necessary to use and enlarge both the "STOP" sign and the pre-warning sign.

An interesting study was made by the Planning Division of the Michigan State Highway Department of the obedience obtained at a location where "STOP" signs of different sizes were installed. With a standard 24 inch "STOP" sign with 6 inch copy in place, this study showed that the disobedience of drivers was 8.6% in daylight and 16.6% at night. The disobedience of a 36 inch "STOP" sign at the same location with 8 inch copy was 2.6% in daylight and 3.8% at night.

Another factor that lends support to the use of larger "STOP" signs is the greater stopping distances required by higher speeds. It is possible to obtain the necessary warning required for a stop from 80 miles per hour by using 18" copy in the "STOP" sign. This would obviate the installation of a pre-warning sign and at the same time the larger sign offers the advantage of having a greater attention value. Larger signs are especially needed on multi-lane highways. Here the driver must first get in position to make his maneuver. When he is in the center lane and traveling at high speed it is very difficult to see any small signs placed on the shoulder, especially when there is considerable traffic on the roadway. In the first place the sign is at least 28 feet to the right of his eyes and secondly, his vision may easily be blocked by vehicles traveling in the same direction in the outer lane. These difficulties are doubly serious under night driving conditions. Under these conditions the use of large signs presents about the only way through which these difficulties may be overcome.

No attempt has been made thus far to assign any lower or upper limits as to the size of signs needed for high-speed highways. Various conditions demand different treatment. However, there is one aspect of the human ability to perceive signs that points to a minimum size of copy below which it is unsafe to go in placing signs upon high speed roads. As an example, let us consider the legibility distance of a four inch message sign which is visible 200 feet in daylight. At 70 miles per hour a vehicle would travel this distance in 1.9 seconds. With a 6 inch message sign the visibility distance is 300 feet and the time to travel this would be 2.8 seconds. These time values become even more critical under night conditions, driving in the face of approaching vehicles with bright headlights.

When the time for glare recovery is considered along with the rapidity with which vehicles may travel through the legibility range of a small sign the difficulty of seeing the signs becomes apparent. Under these conditions, for example, the legibility range for a 4 inch message is reduced to 170 feet and the time for a vehicle to travel this distance at 70 miles per hour is but 1.6 seconds. Thus, the time which the driver has to read the 4 inch sign is 1.6 seconds minus the time his vision is reduced by glare. These facts seem to indicate a minimum sign copy of 6 inch Series "D"

letters. Even with this copy the reading time is only 2.4 seconds, which allows little or no margin of safety. The claim is often made that our highway system is over-signed. If such is the case this condition can be improved in part by the use of larger signs. In many locations one large sign can do the job of two or even three signs. What is more, a large sign will often do a better job. By reason of its size a large sign stands out, attracts attention, and seems to command more respect. Then too, in some cases, it is less expensive to build one large sign than it is to install two or three smaller signs.

There are also many other phases of this problem which need to be studied and discussed. Among the questions which are yet to be settled are:

Can the effectiveness of small signs be maintained when others are enlarged?

If all signs were enlarged, would the net effect be any greater than is now achieved?

Will large signs cause drivers to misjudge distances?

Is there any advantage in maintaining standard shapes which in designing large signs are to convey a meaning?

What type of reflecting element adaptable to large signs is most efficient and under what conditions?

What changes in the standard block type letter will increase the sign's appearance and legibility?

These and other questions should be settled so that the various states may go ahead with improvements in signing with some degree of uniformity.

A digest of a paper presented before the American Association of Highway Officials 1941 Convention Detroit, Michigan.

STATE JAILS BOYS WHO MOVE ROAD SIGNS

The mutiliation, destruction or removal of official State Highway Signs is a violation of law punishable by arrest, and imprisonment of the guilty person upon conviction in court.

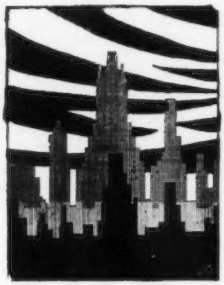
The cost of material and maintenance of the signs of the State Highway System approximated $160,000 last year.

A recent instance was the case of two boys who were returning from a holiday trip in the mountains and ran out of gas at a highway intersection. A third boy, the driver of the car, caught a ride to the nearest service station for gas, and while he was gone the other two removed and put in their car a reflectorized sign reading "Detour' 'and moved another sign reading "Bridge Out 8 Miles Ahead" to another location in the intersection where it gave a false message to traffic.

Later the boys ran out of gas and abandoned the car for the balance of the night. The Police Department found the "Detour" sign in the car, hunted up the boys and found out from them what had happened. The State Highway District Office was notified, the District Traffic Engineer made an investigation and signed a complaint.

The complaint was filed with a Justice of the Peace and a warrant for the arrest of the boys was issued. The older boy was sentenced to 10 days in jail, but the sentence was suspended on the condition that he replace the signs in their original position (which had already been done by highway employees) and also repair all damaged signs between the intersecting routes, for a total distance of approximately 44 miles.

The younger boy whose case was referred to the Juvenile Court, was apparently only reprimanded by the Judge. — California Highways and Public Works, October 1941



Stop, Look and Listen

PRESENTING
THE EDITOR—WEST COAST EDITION

To Associate Editor John Beakey (Mem. I.T.E.), Traffic Engineer, Oregon State Highway Department, Salem, Oregon, go the congratulations and the appreciation of the editors of TRAFFIC ENGINEERING and members of the Institute of Traffic Engineers for his work in preparing this West Coast Edition of TRAFFIC ENGINEERING.

Associate Editor Beakey has set a high standard of reporting and regrets that conditions made it impossible to get full representation of all the West Coast States.

PERSONALS

Laurence B. Tipton (Affil. I.T.E.), Federal Supervisor of Safety and Health Training in War Industries, has been appointed by direction of President Roosevelt, a Captain in the Army of the United States and assigned as Aide-de-Camp to the Secretary of Labor and will continue to be in charge of Safety and Health Training in Army, Navy and War Industries.

Captain Tipton was formerly editor of TRAFFIC ENGINEERING and Director, Bureau of Public Safety, Rutgers University, New Brunswick, New Jersey.

Lloyd F. Rader (Affiil. I. T. E.) former Professor of Civil Engineering, University of Wisconsin, is now on active duty as a Lt. Commander with the United States Navy in charge of construction at the Naval Station, New Orleans, Louisiana.

ACCIDENTS DECREASED

The National Safety Council reports that considerable progress has been made in the Nation-wide Emergency Safety Campaign. Colonel John Stilwell, president of the N.S.C., said, "The upward surge of traffic accidents has been cut in half since the drive began. . . . Our job is now to redouble our efforts, pitch in harder than ever and carry on to eliminate accidents."

48″ Panel 24″ Panel

◆ DAY ◆ NIGHT

MEETING the EMERGENCY

Reflector Signs now easily made with "REFLECTO-CHAIN"

FOR BLACKOUTS
Available in luminous finish to reflect *with* light and glow *without* light —a recent foreign development.

"REFLECTO-CHAIN" *is the quick solution to the emergency created by the shortage of steel.* The answer to Defense restrictions. It can be readily applied to metal, however it is even more easily attached to *Wood* or *Plywood.* Flexible as a string. Any size or style of letter, figure or symbol, can be formed and easily mounted by means of its special screws or nails. If required, it can be furnished to function with complete invisibility from overhead, and, without impairing its horizontal effectiveness. Old or new signs, of any size and type, can be quickly and inexpensively converted into Reflector Signs by using "REFLECTO-CHAIN." The treatment can be with single, double or triple rows of buttons, also by designs, (note illustration) and with different reflecting colors. Write for descriptive literature and prices "Reflecto-Chain" and also Reflector Pavement Markers. Send for trial shipment today.

Manufactured under U. S. Patents Numbers 2,240,777; 2,113,759.

THE STAR-LITE CO.
312 EAST MARKET STREET
INDIANAPOLIS, INDIANA

IN MEMORIAM

Members of the Institute of Traffic Engineers extend their sympathy to the relatives and friends of the Hon. Harry Tucker (Affil. I.T.E.), former Director of the Engineering Experiment Station, North Carolina State College and Commissioner of the North Carolina Utilities Commission.

Professor Tucker passed away in March of this year. His death means the loss of a loyal and ardent supporter, but his contributions to the field of traffic engineering will be a lasting inspiration to present and future members of the traffic profession.

TRAFFIC TRAINING INSTITUTE

The Fifth Annual National Institute for Traffic Training will open at Yale University, June 15.

The Traffic Engineering Section will be directed by Professor Theodore M. Matson (Mem. I.T.E.), Yale Bureau for Street Traffic Research. Special emphasis will be placed upon the application of methods and techniques most useful in providing a safer and more rapid movement of military, war production, and civilian traffic under emergency conditions.

Inquiries should be directed to Sidney J. Williams, Executive Secretary, National Institute for Traffic Training, 20 North Wacker Drive, Chicago, Ill.

CHICAGO PARK DISTRICT CHANGES

The following changes took place in the Traffic Section of the Chicago Park District:

Mr. Otto K. Jelinek, Traffic Engineer, (Mem. I.T.E.) was appointed by Mayor Edward J. Kelly, United States Co-ordinator for the Chicago Metropolitan Area. The Chicago Park District has consented to loan his services to fill this important post in the Office of Civilian Defense. His position will be of responsible charge of all matters pertaining to Blackouts, Lightups, Camouflage, Shelters and Traffic.

Victor G. Hofer, Assistant Traffic Engineer (Assoc. I. T. E.) is Acting Traffic Engineer during Mr. Jelinek's absence.

Philip E. Taylor, Traffic Engineering Designer (Assoc. I.T.E.), a Reserve Officer, has left to report for active duty as 1st Lieutenant in the Traffic Control Section, Corps of Engineers, at Fort Belvoir.

Edward Baumel, Junior Traffic Engineer (Jun. I.T.E.), has been promoted to Traffic Engineering Designer.

LONGEST ONE-WAY HIGHWAY?

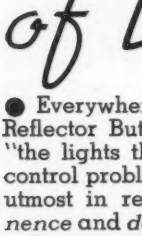
During the period of construction of a large army cantonment in Oregon, it has been found necessary to invoke one-way traffic on a main highway and take over a county road parallel to and one and one-half miles distant for traffic in the other direction. The one-way traffic extends for approximately six miles between the camp and the largest nearby city.

Although it means driving a considerable distance out of their way in some instances, most of the farmers in the area affected have been very cooperative.

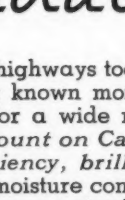
Beacons of Dependability

● Everywhere on the nation's highways today, Cataphote Reflector Buttons are becoming known more and more as "the lights that never fail." For a wide range of traffic control problems . . . engineers *count on Cataphote* for the utmost in reflector button *efficiency, brilliance, permanence* and *dependability!* No moisture condensation . . . no yellowing with age . . . brilliance guaranteed 3 years! These Reflector Buttons scientifically designed to reflect only direct rays — not visible to aircraft. Send now for details. Western Cataphote Corporation, Toledo, Ohio.

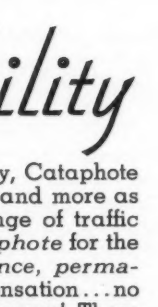
CATAPHOTE REFLECTOR BUTTONS



FRONT ENTRANCE mounted buttons available in five sizes.



REAR ENTRANCE unmounted buttons for wood or metal signs.



Front Entrance Buttons for wood signs... in 5 sizes . . . easily, quickly installed.

TRAFFIC COUNTING SIMPLIFIED WITH NEW TRAFFIC COUNT DENOMINATOR

Illustration of 3 unit Counter, classifying directions of travel

Other models with from 1 to 12 classified counting units mounted in horizontal line.

By simply pressing key one count is recorded in classified counting unit controlled by that key. •

Touch method employed permitting operator to keep eyes on road at all times. •

Quick reset returns all counting units to zero. •

Counting units may be classified to represent direction of travel, different types of vehicles, state license plates, and other important classifications in traffic planning. •

Now in use by City, County and State Highway Departments throughout the U.S.A. •

Quick . . . Accurate . . . Efficient.

— WRITE FOR CATALOGUE —

THE DENOMINATOR CO., Inc. - 261 Broadway, N. Y. City

MEMBERSHIP

Transfer to Associate Grade:

Thomas Edward Willier
Traffic Engineer, City of Houston, Room 902, City Hall, Houston, Texas.

Application for Membership:

Sidney Arthur Anger
Traffic Director, City of Lansing, Michigan. (Home) 109 Lahome Street, Lansing, Michigan.

Lloyd A. Bowman
District Engineer of Traffic, State Highway Commission of Indiana, Fort Wayne, Indiana.

Frederick B. Crandall
Automotive Economist, Traffic Engineering Division, Oregon State Highway, Salem, Oregon. (Home) 555 North 20th Street, Salem, Oregon.

Holden Morrison Leroy
Assistant Traffic Engineer, State Highway Commission of Indiana. (Home) 5343 Carrollton Avenue, Indianapolis, Indiana.

Lawrence Stuart Waterbury
Associate Engineer, Parsons, Klapp, Brinckerhoff & Douglas, 142 Maiden Lane, New York City.

O & D IN COLORS

A recent origin and destination survey made by the Traffic Engineering division of the Oregon State Highway Department is interesting because of the methods used in obtaining the data.

The problem involved the advisability of improving an existing main route through the city or the improvement of an existing by-pass, and the extent of use of the by-pass at the present time.

PROTECT THOSE WHO PROTECT U. S.

It is important to keep the man driving who is "helping to keep 'em flying". Three shifts around the clock means night driving on primary and secondary roads for many defense workers. Now, when every minute counts, it is important that there is no break in the production flow due to accidents.

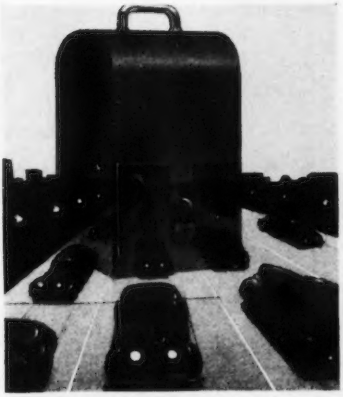
Traffic engineers today therefore face greater problems which must be solved with smaller operating personnel.

Use rust-resisting steel FIREBALL signs and signals to solve your safety problems. Send for complete catalogue.

"Fireball"
REFLECTING BUTTONS, SIGNS & SIGNALS
MANUFACTURED BY
THE NATIONAL COLORTYPE CO., INC.
BELLEVUE, KY.

Traficounter —— PUTS THE FINGER ON TRAFFIC BOTTLENECKS

Today, traffic flows smoothly on the road illustrated. But suppose a large factory started an expansion program to produce war materials, current traffic flow records would be needed to know the psychological time to reroute the flow—prevent a bottleneck. How can this be done quickly, without additional man-power and work? The portable, automatic, recording TRAFICOUNTER is the answer. It can be installed in about ten minutes. Volume is printed every fifteen minutes. The Recorder resets to zero hourly. Write for quotations.



SPEED ACCURACY

STREETER-AMET COMPANY
4103 RAVENSWOOD, CHICAGO

STREETER-AMET COMPANY

Stations were set up at the two ends of the route and, as each inbound vehicle passed, a small card was attached to the front bumper. The cards bore the numerical designation of the station and, before being affixed to the bumper, were stamped with the time to the nearest minute by means of an electric time recording device. The cards were then removed at the outbound station and again stamped with the time.

Intermediate stations were established on both the by-pass and a third route available to traffic to determine which of the three routes had been used. The intermediate stations were located at points where traffic was compelled to stop. As each vehicle stopped, its bumper card was marked with colored pencil.

The data were later transferred to punch cards and tabulated.

STEEL SIGN SUBSTITUTES

Curtailment of the use of steel for the manufacture of traffic signs, while undesirable, will not seriously inconvenience the Oregon state highway department. For many years the department has used plywood and masonite for many signs which because of varied wording do not justify the making of steel dies necessary for the manufacture of embossed steel signs.

The first experiments with plywood signs were unsatisfactory due to inability to obtain a dependable waterproof glue. Even with glue of good grade, certain problems of manufacture worked against obtaining boards of uniform strength.

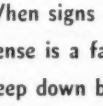
However, in recent years the so-called "hot press" method of manufacture has been developed insuring boards of long life even when exposed to the most inclement weather.

ELECTRIC SIGNALS

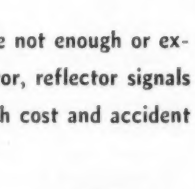
Standard signals adapted for all types of mounting. Synchronous and induction control mechanisms and accessory devices.

REFLECTOR SIGNALS

When signs are not enough or expense is a factor, reflector signals keep down both cost and accident rate.



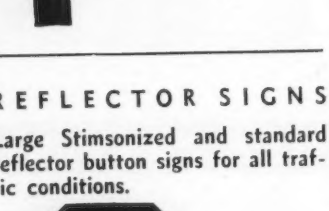
8″; Six 1⅝″ Stimsonites



15″; Six 3″ Stimsonites

REFLECTOR SIGNS

Large Stimsonized and standard reflector button signs for all traffic conditions.



72″ SIGN
18″ LETTERS

24″ SIGN
6″ LETTERS

DELINEATORS

Reflector Delineation gives essential road information after dark at daylight distances. The alignment and driving limits of the road are outlined by a channel of light.

SIGNAL SERVICE CORPORATION

SS SIGNALS

ELIZABETH, N. J.

INCREASING STREET CAPACITY

Mr. J. W. A. Bollong, Traffic Engineer of Seattle, Washington, offers measures to obtain greater capacity out of our existing street systems.

Parking:

When arterials are operating at capacity volume, the removal of curb parking adds one to one and one-half lanes capacity.

During the A.M. peak truck loading and unloading should be permitted thus removing double parking of trucks later in the day.

Alleys should be reserved for only truck loading and unloading, be made one-way and parking should be restricted to one side.

Where street loading and unloading is necessary, adequate curb loading zones should be provided with a wartime limit.

Loading bays and curb cut backs should be encouraged.

New and suddenly expanded industrial plants should be required to provide off-street parking space directly adjacent to their establishment and separate parking areas should be provided when two or more shifts are employed.

Permits for building construction or street openings should be given only when the minimum of traffic interference is occasional.

Deliveries should be made in the Central Business District only in small conveyances, and trucks and trailers should not be allowed to enter the central district.

Parking meters should be installed to reduce double parking, provide more space for parking and decrease the number of traffic officers assigned to parking.

Signals:

When signals are installed within 500 feet of each other, they should be progressively arranged and programmed for morning and evening peaks.

Traffic checks should be taken repeatedly, and signals retimed to comply with new conditions.

The shortest cycle should be used.

Signal speeds should be indicated by 18" x 24" or larger illuminated or reflectorized signs.

Traffic Lanes:

All important highways should be laned and additional lanes placed at approaches to traffic signals.

Lanes should be narrowed to a minimum of eight feet at signals if possible to obtain additional lanes.

Traffic officers should require motorists to use lanes.

Signs should be erected directing slow traffic to curb lanes.

Passing may be permitted to pass on right or left when highway is laned.

Channelization should be obtained at large intersections by traffic lines.

Transit:

Use of transit facilities should be encouraged because of their greater passenger efficiency.

Skip stops should be installed.

Left turns should be reduced in congested districts by rerouting.

Street car loading zones should be located on the near side and parking prohibited 30 feet each side of the zones.

Danger zones should be provided.

Trolley, bus and motor coach stops should be a minimum of 52 feet for 1 coach, 88 feet for 2 coaches, and 125 feet for 3 coaches and be located on the far side.

Stops should be outlined with paint.

The staggering of working hours so as to smooth out traffic peaks between 6 and 9 a.m. and 3 and 6 p.m. will do more to reduce congestion than any other single step.

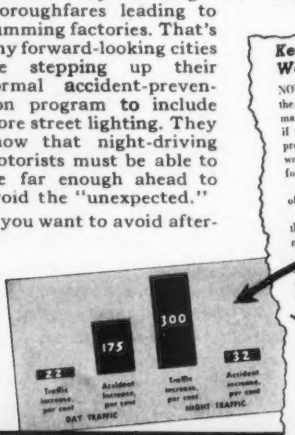
A digest of an original article by J. W. A. Bollong (Mem. I.T.E.), City Traffic Engineer, Seattle, Washington.

SLOW DOWN NIGHT ACCIDENTS...SPEED UP WAR EFFORT
with ADEQUATE LIGHTING

Street lighting in Hartford, Conn.

WHEN nighttime traffic is normal, ordinary driving and walking habits, combined with obedience to regulations, keep accident rates from skyrocketing. Today, the traffic pattern has changed. Streets that were relatively unimportant yesterday suddenly become important. They are dangerous thoroughfares leading to humming factories. That's why forward-looking cities are stepping up their normal accident-prevention program to include more street lighting. They know that night-driving motorists must be able to see far enough ahead to avoid the "unexpected."

If you want to avoid after-dark accidents (and what city doesn't?) it will pay you to study every street where accidents occur. Chances are you'll find they need modern traffic-safety lighting. And you'll find the lighting specialist in the nearest G-E office ready to help. Start today. *General Electric Company, Schenectady, N. Y.*



Keep 'Em Lighted and We'll Keep 'Em Flying

NOT ONLY IS WAR taking its expected human toll on the battle front but on the home front as well, killing and maiming workers in a totally unexpected way. Moreover, if the President's request for 24-hour, seven-day week production can be complied with the slaughter will be worse. We are referring to the mounting accident record for highways leading to and from defense plants.

Two streets in take most of the traffic to and from the plants of As employment increased the traffic accidents on these two streets grew. And then modern street lighting was installed.

Four months later, when daylight traffic had increased 22 percent, but because of extra shifts night traffic on these two streets had trebled, the day accidents rose 175 percent and the night accidents but 32 percent.

Had the lighting of these two streets not been [illegible] the night accidents would have risen [illegible] as fast or faster than the day record [illegible] traffic increased traffic, and many a plane that is now helping our Army and Navy avenge Pearl Harbor would not have been built.

These are the days when every American is probing himself to discover what he can best do to hurry the final victory. To the utility street lighting man comes a special opportunity of lighting for maximum safety the roads that carry our workers to and from the plants that make our planes, our tanks, our battleships.

These are the highways to victory—keep 'em lighted and we'll keep 'em flying.

EDITORIAL FROM ELECTRICAL WORLD

GENERAL ELECTRIC